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Condensation of a lattice gas in three dimensions

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We investigate the condensation transition of a lattice gas model [1, 2, 3]. This simplified model is restricted to nearest-neighbor interaction. For fixed density it is equivalent to the Ising model at fixed magnetization. In order to investigate the temperature dependence, we apply a novel parallel multicanonical method [4]. By this means, the diffusion properties of the particles can be adjusted in such a way that free-energy barriers can be circumvented. Keeping the density fixed, the condensation transition is studied as a function of system size. Our results may further be compared to an analytic prediction of equilibrium droplet formation [1]. To this end, we choose a fixed temperature and compare the average largest droplet to a rescaled density. Above a critical density, a single droplet is observed that includes more than half of the particle excess, consistent with theory.

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